Pulmonary Alveolar Proteinosis Related to Chronic Cotton Dust Exposure and Hepatitis-C Infection

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Abstract

A case of pulmonary alveolar proteinosis developing in a patient with chronic dust exposure and hepatitis-C infection is reported. He was managed with modified bronchoalveolar lavage and granulocyte-monophase-colony stimulating factor. [Indian J Chest Dis Allied Sci 2016;58:183-184]

Key words: PAP, Cotton, Hepatitis-C, Lung, Macrophage.

Introduction

Pulmonary alveolar proteinosis (PAP), a diffuse lung disease, occurs due to the accumulation of surfactant in the alveoli. These lipoproteins once utilised are degraded by the alveolar macrophages. Any defect in granulocyte-monophage-colony stimulating factor (GM-CSF) signalling can lead to dysfunction of macrophages, with subsequent accumulation of surfactants, resulting in PAP. Chronic exposure to inorganic material and rarely to organic material are known to cause PAP. A few cases of PAP have been reported in patients with cotton dust exposure, but hitherto, the association of hepatitis-C with PAP has not been established. We report a case of a 56-year-old male with significant cotton dust exposure and chronic hepatitis-C infection, who later developed PAP.

Case Report

A 56-year-old male, working in a cotton mill, with a significant history of cotton dust exposure for the last 20 years, presented with productive cough and breathlessness since four months. He had earlier been treated for sputum-positive pulmonary tuberculosis two years back. He was found to have tachypnoea, tachycardia and was hypoxic at the time of presentation at emergency department of our hospital. The total leucocyte count was elevated. The chest radiograph (postero-anterior view) showed bilateral non-homogeneous opacities in the lower and mid zones (Figure 1). High resolution computed tomography of the chest showed crazy pavement appearance in the right middle and both lower lobes (Figure 2) with consolidation in the left lower lobe. Enzyme-linked immunosorbent assay test for human immunodeficiency virus (HIV) antibodies was negative, and positive for hepatitis-C antibodies.

Figure 1. Chest radiograph (postero-anterior view) showing bilateral inhomogeneous opacities in the lower and mid zones.

Flexible fiberoptic bronchoscopy was done, and the ‘milky’ bronchial washings obtained were sent for analysis. The bronchoalveolar lavage (BAL) fluid stains and cultures were negative for mycobacteria and also for other pathogens. However, the BAL sample was positive for periodic acid-Schiff stain (PAS), which with the clinico-radiological picture was virtually diagnostic of pulmonary alveolar proteinosis. In view of the worsening clinical status, the patient was intubated with a double lumen endotracheal tube and whole lung lavage was carried out. Milky white, viscous proteinaceous fluid was
drained. The patient’s oxygenation improved along with radiological clearing of the opacities after the lavage. Subsequently, with reaccumulation, repeated bronchoscopic lung lavages were done, alternating between the lungs. The patient was also started on GM-CSF at a dose of 5µg/kg body weight daily. The patient made a steady improvement. He continues to be followed-up on a regular basis, and is clinically stable.

Discussion

Surfactants are phospholipoproteins produced by type-2 pneumocytes. Alveolar surfactant is normally taken up, either by type-2 pneumocytes or by alveolar macrophages, through GM-CSF signalling for recycling or degradation, respectively. A signalling defect of GM-CSF curtails the capacity of macrophages to degrade the surfactant material, leading to abnormal accumulation and PAP. The defect in macrophages in primary PAP is due to antibodies against GM-CSF. A reduction in the number of alveolar macrophages or their functional impairment is the basis for secondary PAP. Inhalation of inorganic dust like silica and cement have been described as secondary causes of PAP.

Organic dusts, such as cotton dust, as a cause of PAP is, however, a rare entity, with only three cases have been reported in the literature so far.

Systemic infections, like HIV and pneumocystis can also cause PAP. Hepatitis-C that was earlier known to be only hepatotropic is also known to affect monocytes and macrophages. Hence, chronic hepatitis-C infection predispose to dysfunction of macrophages, contributing to PAP.

In the case reported here, we speculate that cotton dust exposure could have led to impairment of macrophage function and super-imposed hepatitis-C virus infection may have acted as ‘second hit’ in precipitating PAP. The previous history of pulmonary tuberculosis might also contribute to innate macrophage dysfunction.

Cotton is a cellulose, a polysaccharide that is not catabolised by humans due to the lack of enzymes for breaking it down. Inhaled cotton cellulose fibres overburdens the macrophages and interferes with their function, consequently diminishing the surfactant catabolism. DeLucca et al state that the physical properties of surfactant are altered by aqueous extracts of cotton, affecting their degradation and result in abnormal surfactant accumulation. Cotton dust, hepatitis-C and Mycobacterium tuberculosis in the present case may have acted synergistically.

This rare association is not only important from an aetiological point of view but also from a management perspective. Though effective treatment consists of whole lung lavage, in resource-limited settings, bronchoscopic lavages can be a good alternative. Further, the use of GM-CSF is an effective long-term treatment. Interferon treatment of associated hepatitis-C is debatable, as it may worsen PAP by suppressing bone marrow derived macrophages.

References